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(54) Title: DECORATIVE FILMS AND LAMINATED FORMABLE SHEETS WITH DUAL PROTECTIVE FILM LAYERS <div style="text-align: center;"> </div> (57) Abstract <p>A decorative film (10), such as a film of pigmented paint (12) or other coating covered by a film of clear coat (14), has the outer (clear coat) surface protected by a removably fixed thermoformable first protective film layer (16). A flexible plastic film forming a second protective layer (18) is removably fixed to the first layer (16). The underlying paint film (12) may be laminated to a thin wall or thick wall thermoplastic formable sheet (22). The second protective layer (18) is removed just prior to forming of the paint film (12) or laminated decorative sheet (10), carrying with the protective film (16) any surface damage marks or irregularities. Subsequent compression forming, as into a body panel or trim part, thus will not cause marking of the paint film (12) from transfer of damage marks since the underlying first protective layer (16) remains undamaged. The first protective layer (16) may remain in place during assembly of the formed body panel or trim part (20, 24) into a vehicle, and thereafter until delivery of the vehicle by a dealer to a customer. The second layer (18) may act as a carrier for the films and is stripped from the first protective layer (16) before forming, so it may be made from non formable material such as PET polyester.</p>		

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DECORATIVE FILMS AND LAMINATED FORMABLE SHEETS
WITH DUAL PROTECTIVE FILM LAYERS

Cross Reference to Related Applications

This application claims the benefit of U.S.
5 Provisional Application 60/020,448, filed June 18, 1996.

Field of the Invention

This invention relates to laminated decorative
films having removable protective layers and to formable
plastic sheets laminated with such decorative films and
10 formable into body panels or trim components, such as
for automotive vehicle bodies and other suitable
purposes.

Background of the Invention

It is known in the art to provide formable
15 decorative films of paint, and other materials such as
clear coat, wood grain, ink, chromium, and other metals
for use in forming the exterior surfaces of automotive
vehicle panels. Presently, paint films are available
having an under layer of pigmented paint with one or
20 more over layers of clear coat, the multiple layers
together having a thickness of about 0.0015 inches more
or less as desired. The paint layers are supported by
a carrier in the form of a nonformable plastic film,
such as "Mylar" PET, polyethylene terephthalate
25 polyester film, with a thickness of about 0.002 inches.
Such a film, upon removal of the nonformable carrier
layer, may be shaped by vacuum forming to a prescribed
exterior configuration and then placed in a mold for
injection molding of a substrate against the pigmented
30 color coat layer of paint to form a plastic body panel
or trim component of a desired shape. The injection
molded panel is subsequently trimmed. The clear coat

painted surface then forms the decorative exterior of the formed component.

To stiffen the decorative film for handling between formation of the film and injection molding or other processing, the carrier supported film may be laminated to a thin formable sheet of TPO, thermoplastic polyolefin, commonly 6 mil to 20 mil thickness (.006 to .020 inches). The TPO is laminated to the color coat side of the decorative film, which is opposite from the PET carrier layer prior to its removal.

If desired the clear coat side of the decorative film may be protected from damage after removal of the nonformable carrier layer by applying, in any suitable manner, a removable protective film layer of thermoformable, stretchable, plastic material of suitable thickness, such as about 0.002 inches. This layer may remain in place during the subsequent forming process and thereafter as long as desired prior to removal, even up to the time of delivery of the product to an ultimate customer.

In accordance with a commonly assigned copending U.S. patent application Serial Number 08/788,131, filed January 24, 1997, the multi-layer film, with or without the thin sheet of TPO, may be laminated to a thick wall thermoplastic sheet of TPO (0.065-0.3 inches thick). The resulting decorative sheet may be compression formed, or compression/vacuum formed, to make a structural or trim panel or component for vehicle bodies or other uses.

Summary of the Invention

In development of the process for compression forming of laminated decorative sheets as described in U.S. patent application Docket No. 01003.002, damage to the underlying paint film sometimes occurred even though the clear coat outer surface was protected by a removable formable first protective layer. It was found that if the surface of the first protective layer was scratched or otherwise damaged in handling, a subsequent compression forming step would transfer marks from the damaged surface onto the protected clear coat paint surface. Thereafter, removal of the protective layer would reveal a marked paint surface that failed to meet specifications for automotive paint finishes.

The present invention provides a solution to this problem by applying a second protective layer of flexible plastic film over the first protective layer to protect it from damage during handling prior to the forming process. The second layer is removed just prior to compression forming, taking with it any scratches or damage. Thus, compression forming takes place with a clean and undamaged surface and the underlying protective and paint layers are unmarked by the forming process. The second protective layer may be made of either formable or nonformable flexible material since it is removed before forming. This second layer may also be used as a carrier for forming the paint films. In that case, the first protective layer would be applied to the second layer with the clear and color coats applied thereafter.

In a particular example, a carrier film, such as mylar of about 0.002 inches thickness is laid down, to which a removable protective film layer of formable plastic is laminated followed by layers of clear coat and color coat, together forming a two-layer paint

application of about 0.0015 inches. This four-layer film may be made into rolls for shipping or storing until subsequent use.

5 In use, the laminated decorative film layer may be applied according to the invention, to a thermoplastic thick wall plastic sheet for use in novel methods of forming such laminated decorative sheets into body panels or trim components for vehicles or into other products for other uses in accordance with
10 co-pending U.S. patent application Serial Number 08/788,131, assigned to the assignee of the present invention. These thick wall formable laminated sheets may have thicknesses in the range from 0.065-0.3 or more inches.

15 Before such forming, the carrier, or mylar second protective film layer, remains in place to protect the lower coatings against damage during handling prior to processing. This mylar layer is then removed prior to processing as it is not capable of
20 being formed to provide a characterized high quality exterior surface. The first protective layer, which is made of a formable plastic film, remains in place during processing of the thick wall plastic sheet into a panel or other component having the decorative film layer in place. This first layer then protects the underlying
25 paint layers or other decorative layers during shipping and handling of the panel and subsequent installation of the panel. The protective layer may then be removed or, preferably, remains in place while the vehicle or other
30 product is shipped to a dealer and is finally removed only at the time the vehicle or product is sold and the dealer prepares the vehicle or product for delivery to a customer. Thus the decorative film layer, applied to a thick wall plastic sheet subsequently formed into a
35 panel or trim component, is protected both during shipment as well as during later forming processes and

thereafter, if desired, for assembly into a vehicle or other product and until delivery to a customer.

In accordance with the invention, decorative films protected with first and second protective layers as described may also be applied to thin wall formable plastic sheets for use in various forming processes. optionally, the thin wall laminated sheets may be bonded to thick wall sheets as described above to form thick wall decorative sheets usable in the manner before described.

These and other features and advantages of the invention will be more fully understood from the following description of certain exemplary embodiments of the invention taken together with the accompanying drawings.

Brief Description of the Drawings

In the drawings:

FIG. 1 is a fragmentary cross-sectional view of a thermoformable laminated decorative paint film having dual protective film layers in accordance with the invention;

FIG. 2 is a cross-sectional view wherein the protected film of FIG. 1 is shown laminated to a thin wall thermoplastic sheet; and

FIG. 3 is a cross-sectional view wherein the laminated sheet of FIG. 2 is shown laminated to a thick wall thermoplastic sheet.

Detailed Description of the Invention

Referring first to FIG. 1 of the drawings in detail, there is shown a laminated decorative film product generally indicated by numeral 10. Film product 10 includes one or more layers of thermoformable material including, in the present instance, a first layer 12 of pigmented paint and a second layer 14 of clear coat. Other film layers, such as ink, chromium, etc., could be substituted for the pigmented paint layer and the clear coat could have multiple layers or be omitted if desired.

Removably fixed, as by laminating, to the clear coat (outer) layer is a first protective layer 16 of thermoformable plastic film. To this film is removably fixed a second protective layer 18 of flexible plastic film. Film 18 may also be thermoformable but it may instead be a nonformable film, such as polyethylene terephthalate (PET) polyester, and may act as a carrier layer on which the other film layers are built up or formed.

In use, the carrier layer 18 protects the underlying films during shipping and handling. However, this second protective layer 18 is removed, stripped off, from the first protective layer 16 prior to forming of the remaining film layers into a desired three dimensional shape for further processing, such as injection molding to a heavier substrate.

FIG. 2 illustrates another use of the film product of FIG. 1 to form a thin wall decorative sheet generally indicated by numeral 20. Sheet 20 includes the layers 12, 14, 16, 18 of film product 10 laminated on the side of the paint film 12 to a thin wall thermoplastic sheet 22. This stiffens the product 20 for handling and provides a structural member which is

thermoformable, after removal of the carrier layer 18, to form a thin wall product. The sheet 20 may be of any desired thickness but is commonly from 0.006-0.020 inches thick. The formed product may also be applied, by injection molding or other means, to a thicker substrate to form products such as body or trim panels for automotive vehicles. Compression forming of such sheets is also possible.

FIG. 3 shows another use of the thin wall decorative sheet 20 of FIG. 2 to form a thick wall thermoformable decorative sheet generally indicated by numeral 24. Sheet 24 includes the laminated layers 12, 14, 16, 18 and 22 of sheet 20. These are further laminated on the side of the thin wall sheet 22 to a thermoplastic thick wall sheet 26 to form the thick decorative sheet 24. The sheet 24 may be used in any desired manner. It is particularly suitable for compression forming or compression/vacuum forming, as described in the previously mentioned U.S. patent application S.N. 08/788,131, to form body or trim panels for vehicles.

The embodiments of FIGS. 1-3 are only examples of the forms which the present invention may take and the uses to which it may be put. Among other alternatives which may be used or developed is the application of the film product 10 of FIG. 1 directly onto a thick wall sheet 26 to form a thick wall decorative sheet. Also, if desired, the carrier layer 18 may be removed, if needed or desired, prior to applying the thin or thick wall sheets to the film layers 12, 14, 16. Also, these layers may be built up in any desired manner with or without a carrier layer.

The second protective layer 18, which may act as a carrier layer, preferably acts to protect the underlayers from damage prior to any type of

thermoforming operation. This is particularly important in the case of compression forming in order to prevent surface damage from being pressed into the underlying paint surface during the forming operation. Removing
5 the layer 18 just prior to compression forming carries with it any surface damage that may have occurred and avoids the problem of pressing irregularities from the damage into the paint. The first protective layer
10 remains in place during forming and may remain thereafter to protect the underlying paint film after forming and installation in a vehicle or other product until its delivery to a customer, if desired.

While the invention has been described by reference to various specific embodiments, it should be
15 understood that numerous changes may be made within the spirit and scope of the inventive concepts described. Accordingly, it is intended that the invention not be limited to the described embodiments, but that it have the full scope defined by the language of the following
20 claims.

Claims

What is claimed is:

1. A laminated decorative film product useful
in the forming of components or panels for vehicle
5 bodies and other uses, said film product characterized
by:
a layer of thermoformable decorative material
capable of forming an exterior finish for a component or
panel;
10 a first protective layer of thermoformable
plastic film removably fixed to the decorative material
and capable of limiting damage to the decorative
material prior to and during subsequent forming
operations and thereafter until removed; and
15 a second protective layer of flexible plastic
film removably fixed to said first protective layer of
thermoformable film and capable of limiting damage to
said first protective layer until removal of the second
protective layer in advance of forming operations.
- 20 2. The invention as in claim 1 characterized
in that said second protective layer is a thermoformable
plastic film.
3. The invention as in claim 1 characterized
in that said second protective layer is a non-
25 thermoformable plastic film.
4. The invention as in claim 3 characterized
in that said second protective layer is a polyester
film.
5. The invention as in claim 3 characterized
30 in that said second protective layer also acts as a
carrier layer on which the other layers are formed.

6. The invention as in claim 1 characterized in that said layer of decorative material includes:

a layer of glossy clear thermoplastic finish bonded firmly to

5 a layer of thermoplastic pigment containing paint.

7. The invention as in claim 1 characterized by a thermoplastic formable plastic sheet firmly bonded to said layer of thermoformable decorative material to
10 create a thermoplastic decorative structural laminated sheet.

8. The invention as in claim 1 characterized in that said plastic sheet has a thickness in the range of from 0.065 inches to about 0.3 inches over at least
15 half the area of the sheet.

9. A thermoplastic decorative structural laminated sheet formable into decorative structural components or panels for vehicle bodies or other uses, said laminated sheet characterized by:

20 a thermoplastic formable plastic sheet;
a layer of thermoformable decorative material firmly bonded to said plastic sheet and capable of forming an exterior finish for a component or panel;

25 a first protective layer of thermoformable plastic film removably fixed to the decorative material and capable of limiting damage to the decorative material prior to and during subsequent forming operations and thereafter until removed; and

30 a second protective layer of flexible plastic film removably fixed to said first protective layer of thermoformable film and capable of limiting damage to said first protective layer until removal of the second protective layer in advance of forming operations.

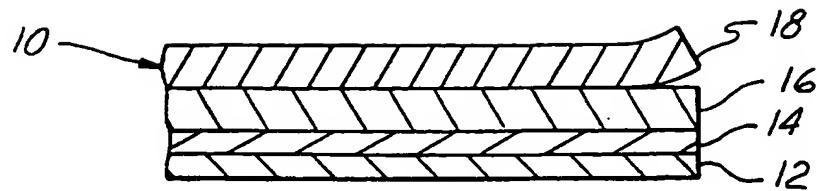
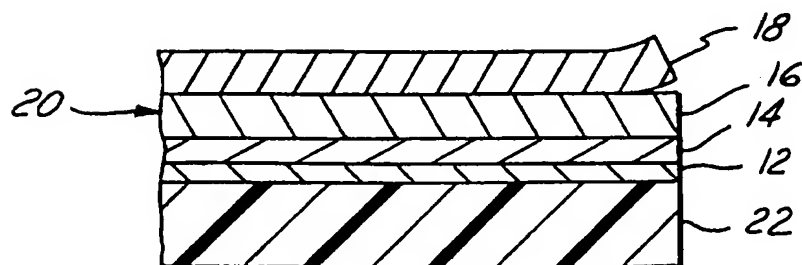
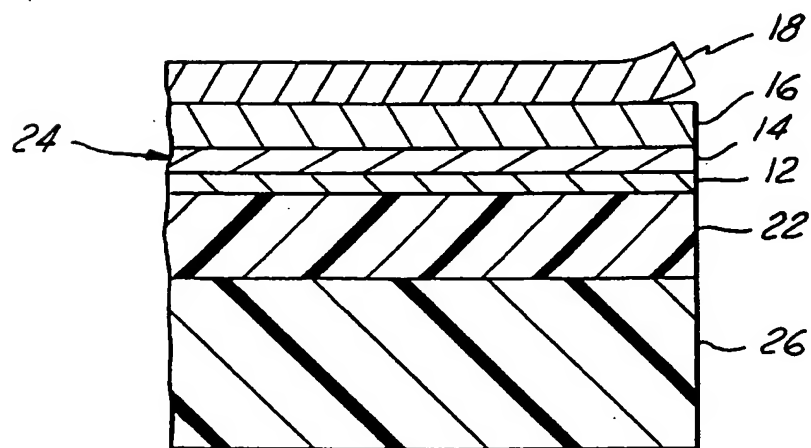
10. The invention as in claim 9 characterized in that said second protective layer is a thermoformable plastic film.

5 11. The invention as in claim 9 characterized in that said second protective layer is a non-thermoformable plastic film.

12. The invention as in claim 11 characterized in that said second protective layer is a polyester film.

10 13. The invention as in claim 9 characterized in that said layer of decorative material includes:
a layer of glossy clear thermoplastic finish bonded firmly to
a layer of thermoplastic pigment containing
15 paint.

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FIG. 1FIG. 2FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/10527

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :C09J 7/02

US CL :428/40.6, 354, 355

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 428/40.6, 354, 355

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,518,786 A (JOHNSON et al.) 21 May 1996, see entire document.	1-13
X	US 4,818,589 A (JOHNSON et al.) 04 April 1989, see entire document.	1-13
Y	US 5,342,666 A (ELLISON et al.) 30 August 1994, see entire document.	1-13
Y	US 4,585,701 A (BARTOSZEK et al.) 29 April 1986, see entire document.	1-13

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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